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Individually Prescribed Instruction (IPI), an experimental instructional method for planning and conducting a program of studies tailored to the learning needs and characteristics of each student, has been in operation in suburban Pennsylvania's Oakleaf elementary school since 1964. Oakleaf's IPI program, which covers the subject areas of mathematics, reading, primary science, and spelling, requires no grades or basic textbooks. The program is based on specific behaviorally stated instructional objectives which are grouped into meaningful sequences representing different levels of progress. IPI allows the teacher to diagnose a child's relative progress on an individual basis and to prescribe appropriate instructional tasks which will enable the child to move on to the next curriculum level. Limited testing and the general evaluations of teachers and administrators working in IPI schools indicate a favorable improvement in student achievement. However, evidence on the effects of IPI is still fragmentary. Three to 5 years of perfecting IPI in demonstration projects similar to Oakleaf's, as well as a retraining program for administrators and teachers, will be required prior to extensive evaluative research. (JH)

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Since it was founded in 1958, *Education U.S.A.* has introduced several new dimensions to educational journalism in the United States. Its weekly newsletter on education scans major developments in preschool to graduate level education. The editors select from hundreds of sources, including reports from their own correspondents in each state, what seems most significant or interesting for the newsletter's readers. The *Washington Monitor* section is a current report on activities at the U.S. Office of Education, Capitol Hill, and other federal agencies involved in education. Every year the editors prepare a special handbook of articles on trend-making subjects in American education, *The Shape of Education.*

Occasionally, the editors decide that some aspects of education are important enough to be covered in detail through special reports. This is the eighth report of this type. Others have reported on problems confronting school boards in an era of conflict; the impending technological revolution in education; significant happenings at the 1966, 1967, and 1968 national conventions of the American Association of School Administrators; the 1967 amendments to the Elementary and Secondary Education Act; and the ways in which computers are being used to help solve the problems of education.

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Additional copies of *Individually Prescribed Instruction* may be ordered from EDUCATION U.S.A., 1201 16th St., N.W., Washington, D. C. 20036. Prices: single copy, $2; 2 to 9 copies, $1.80 each; 10 or more copies, $1.60 each. Payment must accompany orders for $2 or less.

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EDUCATION U.S.A.

SPECIAL REPORT

INDIVIDUALLY PRESCRIBED INSTRUCTION

IPI REVOLUTIONIZING EDUCATION

An experimental public school in a suburban district of Pittsburgh, Pa., is developing a new system of learning which many of the nation's top educators believe will revolutionize the public schools in the years ahead. It is called Individually Prescribed Instruction (IPI).

Under the IPI system most of the 250 pupils of the Oakleaf Elementary School in the Baldwin-Whitehall School District are learning mathematics, reading, science, and spelling at their own individual pace. The program represents a revolution of historic proportions because it is one of the first successful operations of individualized instruction on a systematic, step-by-step basis throughout an entire school program from kindergarten through the sixth grade. Moves are already under way to expand the IPI concept into junior and senior high schools, thus heralding an entirely new kind of secondary school in the years ahead.

Because of the phenomenal interest shown in the project by educators the editors of EDUCATION U.S.A. decided to prepare this special report on IPI. More than 100 visiting educators come each week to Oakleaf to see IPI in action, and 26 more schools--from California to Connecticut--are operating experimental programs. Research for Better Schools, Inc. (RBS), the U.S. Office of Education (USOE) regional laboratory at Philadelphia and the organization implementing Oakleaf's program in other schools, is introducing IPI into 88 schools in 26 states with a total student population of approximately 30,000. Already 1,000 school districts have asked to become a part of IPI. But they will have to wait because the program's directors advise that IPI will not be ready for massive implementation for two or three years.

Enthusiasm for IPI is shared by top-level federal officials. R. Louis Bright, head of USOE's Bureau of Research, says the IPI experiment proves for the first time that it will soon be possible to provide individualized education for each child by techniques that are economically feasible for use in public schools. He calls it one of the greatest educational breakthroughs of recent times.

John W. Gardner, former Secretary of Health, Education, and Welfare, predicts that within 25 years "virtually all instruction in schools will be individualized instruction."

U.S. Commissioner of Education Harold Howe II told the 1968 annual conference of the American Association of School Administrators that individualized instruction should be promoted in every school in the nation.

"Though we have claimed that enabling the individual student to succeed is the objective of our schools," Howe said, "our daily administrative practices claim the reverse. Our marking system represents a group judgment, a

comparison of one student to the 30 others in his class rather than an evaluation of his achievement in relation to his own abilities. Our classes group children according to their birthdays, despite our knowledge that chronological age has an extremely modest bearing on performance and even less on ability.

"We must remove the straitjacket that such arrangements impose on children and allow each to proceed at his own pace, neither holding back the gifted nor forcing the slow," Howe said.

"The results of IPI," he said, "are impressive: many students are performing two to four grade levels above the norm for their age, and the atmosphere of self-directed learning appears to boost attendance and virtually eliminate discipline problems.

"Though final returns on IPI are not yet in, this technique appears to offer a real hope for success with culturally-deprived youngsters as well as for improving the education of average and gifted children," Howe concluded.

Educators have long talked about the need to individualize instruction, but it has been mostly pious talk followed by little significant action. The argument for change has been stated in many ways, including this succinct statement 42 years ago in the Yearbook of the National Society for the Study of Education: "It has become palpably absurd to expect to achieve uniform results from uniform assignments made to a class of widely differing individuals. Throughout the educational world there has therefore awakened a desire to find some way of adapting schools to the differing individuals who attend them." Now, at long last, a practical answer appears to have been found in IPI.

IPI, NEW SCHOOL LAUNCHED TOGETHER

IPI began as an actual, working operation in September 1964, at Oakleaf, which is a new school in a blue-collar suburb of Pittsburgh where most of the fathers work in nearby steel mills. The school, which began its first day as an educational center under IPI, has one class or section at each grade level, grades kindergarten through sixth. The IPI procedure included mathematics and reading (K-6) and science in grade 1 in the first year. Spelling was added in 1968. Instruction is carried on by traditional methods in the other subjects taught at the school.

The USOE-sponsored Learning Research and Development Center (LRDC) at the University of Pittsburgh, which specializes in the research and basic design of new educational technology, is the creator of IPI. The idea was developed into a functioning operation by Robert Glaser, LRDC director; C. Mauritz Lindvall, associate director of LRDC; and John O. Bolvin, IPI director at LRDC. They worked in close cooperation with the University of Pittsburgh and Superintendent W. R. Paynter and his staff at the Baldwin-Whitehall School District.

The idea of IPI began on a small scale. During the school year 1963-64, LRDC and the Baldwin-Whitehall district initiated an experimental project to

investigate the feasibility of a system of individualized instruction in an entire K-6 school. This was the direct result of a series of prior exploratory studies, begun in 1961-62, designed to test preliminary notions on a smaller scale in a single classroom. The work started with the use of programmed instruction in an intact classroom unit in which the teaching practices were oriented around the conventional grade-by-grade progression of learning. As work progressed, it soon became apparent that the significant individualization feature of programmed instruction could not be achieved unless the intact classroom changed its organization to permit a more flexible progression. As a result, a second set of studies was instituted, using programmed instruction and other materials in a more flexible context.

Out of this experience grew the IPI project currently in progress--in which various combinations of instructional materials (programmed materials, special workbook and test procedures) and teacher practices are being used for the purpose of adapting them to individual student requirements.

IPI IN ACTION

How does IPI work?

The difference between IPI and today's typical school is obvious immediately to the visitor. The second and third grade reading class of 63 pupils, for example, is using a learning center--a large room with inexpensive but sturdy record players and their attached earphones placed along the walls. They are also using two adjoining rooms. Two teachers and the school librarian act as coordinators and tutors as the pupils proceed with the various materials prepared by the school's teachers and LRDC.

Most of the pupils are working independently. Some are listening to the record players and completing workbooks as directed by the recorded voice. Some are repeating sounds as directed by the record. Others are working with programmed printed materials at tables in the adjoining rooms. Others are getting new materials for their "next step" from carefully numbered files

How Much More Does It Cost?

Most innovations of significant value have a higher price tag --and IPI is no exception. The latest information available indicates that IPI costs from $37 to $115 more per pupil. The wide variation depends on the quality of education already being offered in a school before IPI is introduced. A school providing a minimum financial effort per pupil will find the switch to IPI resulting in a higher per pupil cost boost than a school already providing higher-than-average financial support.

IPI officials say the cost increase includes expenses for experimental research required in the early stages of the program. Thus, when current extensive research efforts are no longer needed, the overall IPI cost increase will be reduced.

located in the middle of the learning center. A teacher is working independently with three pupils in a corner of one of the smaller rooms. Another teacher is tutoring a single pupil who is having trouble with his current lesson. A teacher aide is correcting a test which will be quickly returned to a pupil so he will know his mistakes before he forgets what he was doing wrong.

To get a closer look at what's going on, let's focus on one of the pupils. Let's call him Jim. He has just been given his new reading "prescription" sheet by his teacher. It indicates the materials he is to study next. He carries it over to the filing cabinet in the learning center. He gets a multicoded reading disc. He places it on a recorder, puts the earphones over his ears, and starts the recorder. A voice says: "Hello, how are you today?" Jim answers: "Very good." The recorded voice then says: "Today we are going to learn about the sounds of letters. Do you have a pencil?" Jim says: "No, but I'll get one." He stops the machine and gets a pencil. In a minute he is back at his place following the record's directions. He is busy filling in the pertinent information on the "prescription" sheet.

When Jim has a question he raises a little red flag, thus telling the teacher he needs help. When he has completed the record, he returns it to its proper place. He then takes his completed lesson to a teacher aide who scores it for him. Jim's teacher evaluates the page, listens to him read, asks some questions, and then, if he performs satisfactorily, the teacher tells him to continue with his prescription.

When a student has completed a prescription, he is tested. The test is corrected immediately, and if he gets a grade of 85 percent or better he moves on to a new prescription assigned by the teacher. If he falls below 85 percent, the teacher offers a series of alternative activities to correct weakness, including special individual tutoring. He is not permitted to advance to a new unit of work until he achieves the 85 percent proficiency rating.

Throughout this process most of the students appear to be industrious and interested in their work. They are mostly self-directed and appear to

Teachers Teach, Students 'Freed'

What happens to pupils and teachers under IPI?

IPI Project Director Robert G. Scanlon at RBS offers an optimistic answer.

"Students," he claims, "are freed from the typical drudgery that most schools generally impose and for the first time they find that learning has real meaning and that school can be lifelike.

"Teachers are given the opportunity to serve as diagnosticians and prescribers of instructional settings and materials," he says. "In this role they best perform what their profession demands--they teach."

enjoy their freedom. Virtually everyone is working at different levels. There is no confusion or disturbing horseplay, a factor which continuously impresses visitors who expect a breakdown in discipline when young pupils are permitted to work on their own.

Mortimer Smith, director of the Council for Basic Education and an educational observer noted for his critical eye, reacted with this comment after visiting Oakleaf: "In the classes we visited attention and application seemed high. We were impressed by the independence and poise of many of the students, especially in a first grade science class. Here the tots filed in, got their individual kits of materials, and proceeded to their own carrels where they put on their headphones and received recorded instruction for use of the kit. One boy we observed was following instructions to divide the soft and hard minerals in his kit. He wrote the numbers on the minerals in the appropriate space in his workbook. Others were engaged in rudimentary science lessons of greater or lesser complexity. The training in careful listening and in following directions seemed especially useful. It was delightful to watch the sangfroid with which most of the children approached their lessons. And one noted that few of them had to ask the attending teachers for further instructions."

Donald Deep, principal of Oakleaf, says a teacher is rarely found lecturing to an IPI class. Instead, she is usually observing a child's progress, evaluating his diagnostic tests, instructing small groups or individuals who need help, and writing individual pupil prescriptions. Teachers review individual pupil prescriptions every day since the majority of the prescriptions do not last more than one class period. Deep says an important aspect of the IPI program is insuring sufficient planning time for teachers to prepare their prescriptions. Most of the clerical tasks, he says, are done by teacher aides, usually local housewives who have a high school education.

Deep's contention that teachers at Oakleaf lecture less than in the typical school is dramatically supported by a research study by Hilton Bialek, senior staff scientist with the Human Relations Research Organization. The study found a sharp contrast between the two systems. In the conventional school the study found that over half of the communications in the classroom had nothing to do with instruction; about 90 percent of the communications were teacher-initiated, and half of these were directed to the single student and half to groups of students; when the teacher talked to one student, it was most likely that the communication was noninstructional; when the teacher talked to more than one student, it was likely that the communication was instructional.

In the IPI class the study found that over three quarters of the communications were instructional in nature; 20 percent of the communications were teacher-initiated and three quarters were directed to the single student; about 80 percent of the communications were student-initiated, and three quarters of these were instructional in nature; there was a trend for the overall number of communications to decrease in the IPI classes. In general, the study found that the responsibility for teacher-student communication in IPI classes fell upon the student and the content of most communication was instructional in nature.

FUNDAMENTALS OF IPI

IPI consists of planning and conducting a program of studies with each student that is tailored to his learning needs and to his characteristics as a learner. Team teaching, nongraded classes, programmed instruction, and grouping have all attempted to accommodate the differences among individuals within the classroom. IPI takes a new direction in this continuing search for ways to adapt instruction to the individual. It has prepared instructional materials designed for the individual student.

IPI is based on a carefully sequenced and detailed listing of "behaviorally-stated" instructional objectives. It works this way:

- Each objective should tell exactly what a pupil should be able to do to exhibit his mastery of a given content and skill. This is typically something that the average student can master in one class period. Objectives involve such action verbs as solve, state, explain, list, describe, etc., rather than general terms such as understand, appreciate, know, and comprehend.

- Objectives are grouped in meaningful streams of content. For example, in arithmetic the objectives will typically be grouped in such areas as numeration, place value, addition, subtraction. Such grouping aids in meaningful development of instructional materials and in diagnosis of pupil achievement. At the same time, this grouping does not preclude the possibility of having objectives that cut across areas.

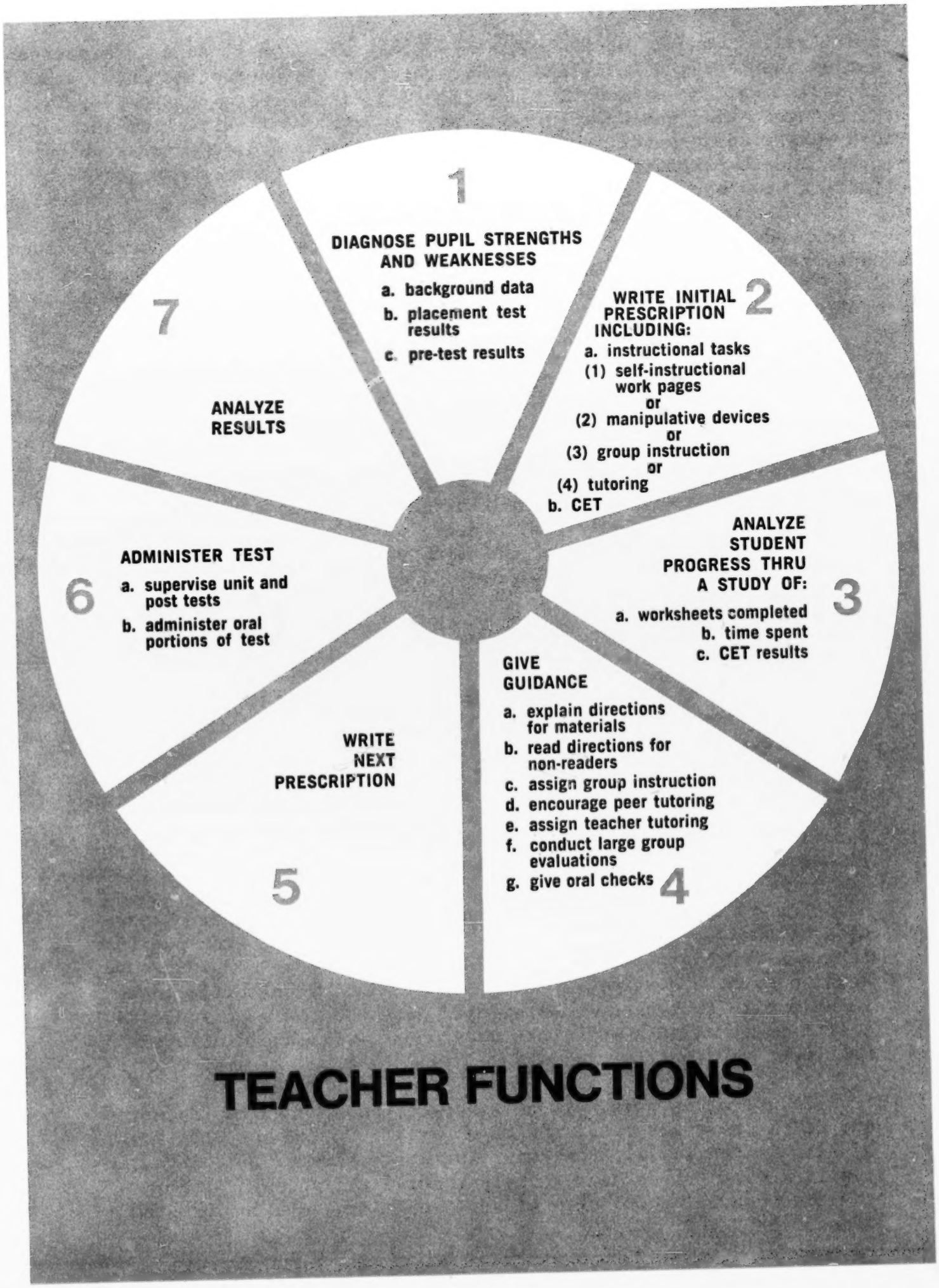
- Within each sequence in each area the objectives are grouped into meaningful subsequences or units. Such units can be designated as representing different levels in progress and provide break points so that when a student finishes a unit in one area, he may either go on to the next unit in that area or switch to a unit in another area. (For example, when the pupil completes Level B Addition he may move on either to Level C Addition or to Level B Subtraction.)

Other fundamentals required for a successful IPI program are listed by IPI Director Bolvin. They include the following:

- IPI lesson materials are geared exactly to the instructional objectives and permit pupils to proceed quite independently and with a minimum of direct teacher instruction.

- IPI requires a detailed provision for diagnosis of pupil skills and abilities and continuous monitoring of pupil progress.

- IPI depends heavily on the teacher. His performance must change from the traditional teacher role in many ways. He will spend little time in lecturing to groups of pupils; he will spend much time evaluating the pupil's record, diagnosing his needs, and preparing individual learning prescriptions for each child; he will spend most of his time helping individual pupils; he will participate in frequent staff conferences to discuss individual pupils, to evaluate and adapt material and procedures, and to make future plans for each child.


1
DIAGNOSE PUPIL STRENGTHS AND WEAKNESSES
a. background data
b. placement test results
c. pre-test results
2
WRITE INITIAL PRESCRIPTION INCLUDING:
a. instructional tasks
(1) self-instructional work pages
or
(2) manipulative devices
or
(3) group instruction
or
(4) tutoring
b. CET
3
ANALYZE STUDENT PROGRESS THRU A STUDY OF:
a. worksheets completed
b. time spent
c. CET results
4
GIVE GUIDANCE
a. explain directions for materials
b. read directions for non-readers
c. assign group instruction
d. encourage peer tutoring
e. assign teacher tutoring
f. conduct large group evaluations
g. give oral checks
5
WRITE NEXT PRESCRIPTION
6
ADMINISTER TEST
a. supervise unit and post tests
b. administer oral portions of test
7
ANALYZE RESULTS
TEACHER FUNCTIONS

SELF-DIRECTION PROMOTED

IPI relies heavily on student self-direction. The student is expected to gather the learning materials called for in his prescription and to go to his desk and work independently. He is expected to cope with the learning tasks assigned him, making efforts to grapple with difficulties he encounters before asking the teacher's help. He is also encouraged to evaluate his progress and to participate in the decision as to whether he has achieved sufficient knowledge of the unit to be ready to take the mastery post-test.

The student is always free to use supplementary learning materials such as audio tapes with spelling or Cuisenaire rods with mathematics. Also, in reading, a part of the assignment time is used for independent reading that is entirely self-directed.

"There are two reasons for regarding self-directed learning as a master key to educational reform," in the opinion of Glen Heathers, professor of educational psychology at New York University and visiting professor at LRDC. "First," he says, "a sound education is one that prepares the individual to be an autonomous problem solver in responding to situations he encounters in his role as student, worker, citizen, family member, community member, or private person. Competencies in self-direction enable a person to chart a life that expresses his individual choices of ends and means. Further, such competencies prepare a person to deal with various kinds of novel problems that confront him in this world of rapid and unpredictable change. The sec-

History of Individualization

A survey of the history of instruction shows that formal learning began very much as an individual affair. "Pupils came to school to receive instruction individually from the teacher," according to IPI Project Director Scanlon. "Education," he says, "was generally for the select few. Therefore, fewer pupils attended school. This made possible the provision of individualized instruction for students. For example, in the one-room school, pupils proceeded on an individual basis rather than as intact groups.

"As educational advantages were offered to a larger proportion of the population, it became necessary to deal with pupils in grade-level groups, and individualized instruction diminished," Scanlon says. "However, as awareness of individual differences among pupils increased, many efforts have been made to individualize instruction even within the context of schools offering mass education."

IPI, Scanlon says, "is an instructional system representing one of the more interesting ways of providing for the wide range of differences we all know exist in any classroom. It certainly typifies what can be done to help resolve the age-old problem--that is, providing for each student, each day, his own program of studies."

ond reason for viewing self-directed learning as a requisite for educational reform," Heathers says, "arises from the fact that effective instruction must be tailor-made to suit the characteristics of each individual learner. Since there will continue to be many times more students than teachers, individualized instruction cannot become the rule until the rank and file of students can conduct much of their learning independently, that is, without continuous guidance and help from teachers."

The self-direction emphasized in IPI is resulting in unplanned and unexpected benefits. IPI pupils, particularly those who have their first school experience under IPI, develop much better study habits than pupils in a traditional school. They learn how to schedule their time and become self-starters, says James Johnson, Oakleaf intermediate teacher.

Johnson says all evidence indicates that IPI pupils become more independent, more highly motivated, and much more able to work effectively on their own without constant direction. In fact, he says, they become more responsible human beings. When they leave Oakleaf for junior high school it is obvious to teachers that IPI pupils are better at working on their own than students from traditional elementary schools.

CURRICULUM AND IPI

IPI is not designed to utilize any particular curriculum materials or to promote any particular curriculum theory. Bolvin says the procedure used in developing the curriculum was to first define the sequence objectives for grades K-6 and beyond for the four subject areas operating under IPI. These sequences were developed after members of the project staff had carefully examined a great variety of possible curricula. Thus, the sequences finally developed for IPI can be properly described as representing at least a partial consensus of recent thinking concerning what should be taught in each of the IPI subject areas.

Subject areas of mathematics, reading, primary science, and spelling are completely individualized. It is possible, for example, to have each of the 33 second graders doing something different in mathematics at the same time. There are no grades or basic textbooks in the four subjects operating under IPI. A third-grade youngster can be doing sixth-grade math and a fifth-grade youngster may be reading at the third-grade level. The only restriction placed upon the child is his own ability to achieve.

The IPI reading curriculum has been developed by sequencing specific reading skills that need to be mastered by each pupil. The skills are worked into units and levels of work much the same as in the mathematics continuum.

The beginning IPI reading program is built around the first 14 programmed texts by Sullivan Associates. This material is supplemented by records and special work sheets prepared by LRDC. A second phase of the reading program is built around paperback published materials. The third phase is the independent reading program in which the children select their reading material from the school's library. Pupils also work on prescribed skills material during this third phase.

The independent or quiet reading is done either in the classroom, library, or at home. The library is always open to pupils, and there is no limit on the number of books a child may take out. "Our efforts are directed toward encouraging a child to read for many purposes, but mainly for his own enjoyment," Oakleaf's principal explains.

In IPI math the curriculum is divided into levels A through I. Each level, which is roughly comparable to a grade level, is subdivided into 13 units--numeration, place value, addition, subtraction, multiplication, division, combination of processes, money, time, system of measurements, geometry, fractions, and special topics. Within each unit there are called behavioral objectives which the pupil must master. He is tested at the completion of each unit. If he achieves 85 percent mastery he moves on to the next unit. In the period from kindergarten to the sixth grade the math curriculum has identified 430 specific instructional objectives.

On the facing page are examples of how the system works for portions of two levels in the mathematics continuum.

IPI DEPENDS HEAVILY ON TESTING

The first item on the agenda every year at Oakleaf--and at the other developing IPI schools across the country--is testing. All students, old and new, take one or more "wide-band" placement tests. They consist of sample items measuring the objectives in each of the units within a level of work.

On the basis of the pupil's performance the year before, an approximation is made of his level of achievement. Testing begins at this point. He is tested over a range which includes what he knows to what he has not yet learned. The results determine the level and unit at which each child should begin the new year in each IPI subject.

The IPI placement test has the following characteristics: it measures mastery for each unit of work; it provides a learning profile for all students along the learning continuum; it is an indicator of strengths and weaknesses of a student; and it focuses on the area or areas that need further diagnosis.

Since several specific objectives are assigned to each unit and level of work, a pre-test is needed to discover which specific objective within the unit and level a student knows and does not know. It is designed to measure the specific objectives within a specific unit and level of the learning continuum. The pre-test is used for each unit and level on the continuum; it measures each specific objective within one level and unit; it provides essential information on the student's strengths and weaknesses in each objective within the level and unit of work and thus helps to determine the learning tasks to be assigned next; its score can be considered the entering behavior of the student for each objective within a level and unit of work.

Post-tests represent the third form of IPI testing. They are an alternate form of pre-test and are assigned at the end of each unit of work to determine pupil mastery of the unit. The post-test score also indicates growth in total behavior for each student of that level and unit being tested.

MATHEMATICS CONTINUUM

	level C	level D
NUMERATION	1. Reads, writes numerals 1-200. Sequence from any starting point. 2. Supplies number 1 more, or less, or in between — 1 to 200. 3. Skip counts 2's, 5's, 10's to 200.	1. Reads, writes to 1,000. Any point. 2. Skip counts, by 3's, 4's from any point. 3. (a) Identifies and reads decimal fractions to hundredths. (b) Converts decimal numbers to fractions and other forms. (c) Fills in missing simple decimals.
PLACE VALUE	1. Identifies place value of the units, 10's, 100's to 200. Indicates >, <. 2. Writes numbers, columns 100's, 10's, units.	1. Identifies units, 10's, 100's 1000's. Uses >, <. Writes number before, after to 1,000. 2. Writes numerals, expanded notation, to 1,000. Regroups, renames. 3. Uses number families, bridging, to work addition, subtraction problems. 4. (a) Gives place value of decimal fractions in fractional or other form. (b) Makes place value chart.
ADDITION	1. Use of associative principle. 2. Adds 2 numbers — sum of 20. 3. Sums of 2 or 3 numbers, no carrying. 4. Uses >, <, =. Equations, 2 step, combining add-subtract. 5. Works column addition — 3 or more addends, sums to 20.	1. Demonstrates mastery, sums thru 20. 2. Does column addition — no carrying. 3. Finds missing addends — 3 single digits. 4. Uses words, sum, addend — labels part. 5. Adds, carrying to 10's using 2 digit numerals, 2 or more addends. 6. Adds, carrying to 10's, 100's, using 3 digit numerals, 2 or more addends. 7. Adds, carry 10's, 100's, using 3 digit numerals, 2 or more addends. 8. Finds sums, column addition. Using 2 or more addends of 1 digit.
SUBTRACTION	1. Subt. problems — numbers to 18. 2. Subt. 2 digit — no borrowing. 3. Finds missing addend — 2 single digits.	1. Mastery subtraction facts, numbers to 20. 2. Subtraction no borrowing — 3 or more digits. 3. Subtraction borrowing 10's place — 2 digits. 4. Subtraction borrowing 10's, 100's — 3 digits. 5. Subtraction borrowing 10's, 100's — 3 digits.

The fourth and last kind of testing used in IPI is the curriculum-embedded test. It is a short test of a student's progress toward a particular objective within a level and unit of work. It has two parts: (1) it measures the pupil's progress toward a particular objective; (2) it serves as a short pre-test of the pupil's ability to achieve the next objective within a unit and level of work.

This description of IPI tests may give the impression that the student feels that he is being tested all the time. LRDC Director Glaser says this is not the student's reaction. "The tests are seen as part of instruction and the students look forward to them because they get immediate information about whether they need additional work in a unit or can test out a unit and move on to new work," Glaser says. "The overall philosophy of this built-in testing program is that at any point in time the student's performance and progress is quickly available. The continuous recording and updating of these performance data seem to make special testing procedures unnecessary. As we get better in designing a curriculum which adapts to individual difference," Glaser says, "I suspect that the test-taking aspect generally present in education will diminish, as perhaps will the test-anxious or test-sensitive student."

WHAT'S AN INDIVIDUAL PRESCRIPTION?

The most difficult and crucial task for the teacher in IPI is providing each student with the most effective prescription for him to achieve lasting understanding of each step on the IPI learning continuum. And it must prepare him for the next step.

What is this prescription that is so all-important in IPI?

It involves several potential alternatives. For example, it could direct the pupil into a variety of learning activities such as: assignment to a teacher for tutor instruction; assignment with a few pupils to a teacher for small-group instruction; assignment to work pages; listening to a tape or disc; or viewing a filmstrip or film.

When the pupil has completed the assigned prescription he is given the post-test. If the test shows he has achieved mastery of the required objectives the pupil is given the pre-test for the next unit of work. If he has not acquired mastery of the subject as indicated by the post-test the teacher prescribes supplemental work.

As now operated, IPI teachers have the responsibility to prepare instructional prescriptions for each student. In the future, LRDC Director Glaser says, "it is conceivable that the teacher might be presented with suggested alternate student prescriptions which she can accept, reject, or modify; certain prescriptions could be presented to the student directly.

"At the present state of our knowledge," Glaser says, "the decision rules for going from measures of student performance to instructional prescriptions may not be very complex, but little is known about the amount of complexity required. The individual monitoring of student performance provides

us with a good data base to study this process. Sustained analysis of such information about individual difference-learning environment relationship should result in the ability to supply the teacher with the kind of data reduction and information that will enable him to manage the task of adapting to individual differences. Study of attempts at individualization should point out how fine or coarse adaptation to individual differences can be with the knowledge at our disposal. Will it be possible to make unique prescriptions for each individual, or will it be discovered that instruction can be quite effective by having, at each decision point, three to 10 instructional alternatives? This may provide all the variability required or that can be produced," Glaser says.

Teachers from IPI schools got together to exchange views on prescriptions and came up with a series of recommended prescriptions for specific pupil problems arising in an IPI classroom.

If a student is bogged down in a particular skill, the teachers recommended these steps:

A diagnosis of the stumbling block should be made using the pre-test, worksheets, or the curriculum-embedded test.

The problem should be brought up at a teacher planning session in order to get suggestions for different approaches or materials. Recommendations made by the planning session would probably include small group instruction; peer tutoring, special tutoring by a different teacher; "hold" the skill, let the child proceed to the next one, and return to it later; return to the previous level and reteach.

If a child is a nonreader, the teachers recommended that the following action be taken:

Teach key words.

Play the following instructional game: have a large chart in color with key words and illustrations. The child can match small cards stating the key words with the big chart.

Assign the child a peer who can read to him.

Use teacher aides to read the directions.

Have the child read aloud.

Assign discs.

If a child daydreams or is bored, they recommended the following action:

Try using a tape recorder if a child refuses to read.

Use a camera.

Skip worksheets.

Let the child write his own worksheets.

Put the nonworkers together with a teacher.

Let him "escape" for a day and do something else.

Take time to let him know you are interested.

If all the children in a class need individual help with different skills and require immediate teacher aid, the teachers recommended the following action:

Ask another teacher for help.

Tell all the children to put down their help flags and help their neighbor.

Push for more individual pupil effort by telling pupils to try on their own until a teacher can come to their aid.

Group the children by the skills on which they are working.

Have games and mathematics extra-work the children can do.

TEACHERS REACT TO IPI

Teachers working in IPI schools, when asked to list functions and responsibilities in IPI that are new, unusual, or different from non-IPI classes, came up with these answers:

Teachers indicated that a transfer of responsibility from teacher to student takes place in IPI. Students were expected to be able to assume some responsibility for their own education.

Teachers have to accept the child where he is.

The child controls his own learning climate.

Teachers must be responsive to each individual child's needs and lesson plans must be flexible for each child.

Teachers must have a knowledge of each child.

Peer tutoring becomes important and students are used in the role of the teacher.

The teacher's orientation is toward the individual and his learning problems. This creates a one-to-one relationship.

Teachers become more aware of gaps in student learning.

Teachers are becoming more of a guide and less of a dictator.

Teachers find a team approach to planning is more effective. No longer are they islands unto themselves.

Communication with other teachers, once optional, becomes necessary.

A wider repertoire of teaching approaches and techniques is required.

Teachers must have a broader knowledge of subject matter.

The teacher is less dominant during actual class time.

Teachers become more aware of the small steps in learning.

Teachers are teaching for mastery of specific subject matter.

Teachers must know more about the materials they intend to use.

The curriculum controls the teacher.

Interpretation of test information is more sophisticated.

Teachers become more alert to all aspects of teaching.

Communication with administrators, once optional, is now a necessity under IPI.

Teachers who had had experience in team teaching and in nongraded programs found the transfer to IPI less difficult.

An indication of the challenges and problems facing the educational innovators who developed IPI is indicated by interviews conducted with all members of the Oakleaf teaching staff at the end of the first year of IPI. Many of the problems cited have since been solved, but the issues raised by the teachers give an interesting insight into potential IPI weaknesses and strengths.

The questions and the teachers' answers follow:

1. What were some of the things you liked about the program?

   The idea or philosophy of individualization was cited without exception. The teachers were unanimously in favor of beginning a child at his own level and allowing him to progress at his own rate through the sequence. Several teachers also commented that an additional advantage for the child was that the program is not boring; it provides a challenge for each student and it develops in the student a sense of self-motivation and independence.

   A majority of the teachers were impressed by the vast amount of information available about each child for the planning sessions and for the prescription writing. Sufficient information was available, thus allowing the teacher to be confident about the decision made for each child.

Several teachers also mentioned the fact that the program allowed for a more efficient utilization of teacher time than did the traditional intact classroom. Not only did IPI provide work for the teacher in a diversity of areas and with a wide range of children; it also did not confine the teacher to a single classroom, a single textbook, or a single set of materials.

In addition, many favorable comments were received concerning the use of teacher aides, library books, the McGraw-Hill reading program.

2. What were some of the things you disliked about the program?

   LRDC-provided materials, equipment, and tests drew the most criticism from the Oakleaf teachers. They said many of the materials were inappropriate or sparse. They expressed a dislike for the equipment and tests in the science program. Other aspects of the program that drew criticism included: oral reading, selection of library books, the arrangement of the large "individualized" room, the size of the group, the delay in decision-making causing students to sit with nothing to do.

3. Do you think all the children at Oakleaf were able to achieve as much as possible in the individualized program?

   The majority decision was "no." Typical comments: "brighter" or "faster" children benefit most; those who are most adaptable to change or those who desire more individual work and less group work are at an advantage under the program. However, when compared with traditional classes, teachers felt all IPI children achieved better.

4. What were some advantages of the individualized program for the students?

   Cited as advantages: slower pupils were not pushed and faster pupils were not held back by any class norm; less competition and frustration and more self-initiated interest and work on the part of each pupil. The teachers found satisfaction in getting to know each child, in the possibilities IPI opened for creativity, and in the rapport which could be established between teacher and pupil.

IPI Demonstration Projects Announced

Five schools are operating as demonstration projects for IPI under the direction of RBS. The schools, which have been working in IPI since the fall of 1966, are welcoming visitation by interested educators. They are Downey Elementary School, Harrisburg, Pa.; Richland Elementary School, Quakertown, Pa.; West Elementary School, Dover, Del.; McAnnulty School, Pittsburgh, Pa.; and Washington Elementary School, Trenton, N.J. Visitation arrangements can be made by direct contact with the schools. More than 500 educators a month are now visiting these five schools.

5. What were some of the disadvantages of IPI for the student? For the teacher?

   The prime disadvantage for the student seemed to have been the adjustment of the slower child to the program. The teachers felt that the slower child was not encouraged to move ahead, was apt to waste time, did not seek teacher aid, and seemed to become lost and discouraged. The lack of immediate instruction and deficiencies in the oral reading program were cited as possible causes for this behavior.

   For the teacher, the pressure and decision-making chores were disadvantages. The teacher needed to be on all levels and in all places, and this proved to be a difficult task.

6. What changes would you suggest in the physical structure of the individualized classes?

   The major criticisms here were the lack of room to spread out and the need for privacy due to the number of students in each room under the supervision of one teacher.

7. How does IPI affect the role of the teacher?

   All the teachers saw their roles radically changed under IPI. They felt that much orientation was needed for this more flexible and relaxed role, which demanded much preparation and little "showmanship." A few said they missed a "captive audience," but they admitted that they found their pupils more responsible. All the teachers agreed that initial adjustment to their new role had been difficult.

ADMINISTRATORS VIEW IPI

The administrators of IPI schools have commented on the strengths of IPI as they see them. Here is what they had to say:

"IPI has the ability to meet individual need and the flexibility to change with time."

"Teachers are meeting the needs of the pupil at the moment."

"IPI offers promising opportunities to teach basic skills meaningfully and efficiently. It eliminates some of the psychological problems caused by graded programs. It is possible for a teacher to truly know her students' progress in terms of the continuum. Eventually it should resolve the transition problems students face when they move from one year to another and from one school to another."

"IPI allows a child to succeed at his own rate. It has a built-in diagnosis of a pupil's strengths and weaknesses. It allows time for the teacher to teach. It offers a variety of materials or lessons."

"IPI is the first workable system we have had which really permits children to advance at their own pace. It is a system which is particularly good for the slower than average student."

"Pupils are interested and teachers involved are enthused."

"It's the closest we've ever come to genuine individualization. It helps children, teachers, and parents to become rapidly involved. It helps children become more self-motivated and self-activated. Children learn their efforts control the direction and rate of their education. The success factor is a real strength."

"Emphasis is on self-control and independence of children."

"This program makes educators begin to evaluate their other methods of teaching which have been accepted as 'sacred' for years. It provides instruction to the slower learning child without stigma. The program provides for a change in the role of the teacher and administrator."

"The administrator is closer to the curriculum, faculty, and students. It offers more individuality than any other known program. It appears that it will break the classification of children by grades. It places more time upon the teacher and the administrator--yet it definitely has brought much happiness to those who are involved to see children make progress--and specific progress at that."

"IPI is truly the beginning of individualized instruction. It's flexible; has definite stated objectives which can be met. IPI is changing and improving--it is not a pre-arranged plan that says it can't be improved."

"The teacher focuses on the children and not the subject."

"IPI offers the opportunity for concerned staff to really know each child and to allow that knowledge to work for the child."

The administrators of the IPI schools also offer comments on weaknesses and problems in the program:

"More adequate teacher and administrative training is required. The continuum must be extended. Additional learning paths and modes of instruction are needed. There must also be more adequate implementation of problem solving within the individual IPI school."

"Cost of the program is too high. A great amount of space is needed for storage of materials."

"I'm not sure this is a weakness of IPI, but such a program does need ongoing training. I'm concerned that more school systems may not have the opportunity to engage in IPI because of a lack of training, or inadequate training."

"Lack of provision for transition into junior high school is a weakness."

"Material revision has become too burdensome. Maybe we initiated the program a year too early."

"We have had difficulty arranging planning and prescription time. The program is constantly changing. One just about gets set up with one program when it has to be changed to another. It's impossible to sell the idea to the members of the board of education when you don't have definite cost figures for each pupil unit. This program requires so much of the administrators' and teachers' time that it sometimes becomes overwhelming. Another problem is to overcome the attitudes of the college faculties and the members of the state education associations. It is difficult to operate the program when the top administration is oblivious to the problems inherent to its program."

"Cost has been the thing that has made it difficult for us to absorb."

"I think the biggest problem is lack of communication--too many people are trying to solve the same problem--and all the while someone else has reached a solution. This is parenthetical because it doesn't apply only to IPI. Worksheets need improvement. Also needed are more materials and a bit more structure for independent reading."

"The advantages so far outweight any weaknesses that it is hardly fair to list any. Most were discussed or touched upon in our discussion."

"Problems are not in any more abundance than with any other new program. Looks good to me."

"An ongoing teacher improvement program is needed for IPI teachers and administrators and teachers new to IPI."

"Its weakness--constant change--is its strength. It changes as the students, teachers, and principals develop or outgrow needs."

What Happens to the Principal?

What happens to the school principal in an IPI program?

The professional staffs of IPI schools believe he has a new role. The principal, they say, must be more accessible to his staff. He must visit classrooms more often and he must be able to pitch in and help the teachers at times.

Sometimes he may have to work as a floating teacher in the classroom or help write prescriptions for pupils if the teacher is bogged down. In addition, they report, the principal becomes the leader of IPI planning sessions with teachers.

And, if this weren't enough, he must become a good researcher who has the freedom to set up flexible scheduling and organization in the school.

RETRAINING ESSENTIAL FOR ADMINISTRATORS AND TEACHERS

A "must" for successful implementation of IPI into a traditional school is a retraining program for both administrators and teachers.

RBS's Scanlon says "principals of elementary schools need help in three basic aspects of IPI.

"The first aspect deals with the problems of organization. Most elementary principals," he says, "are not familiar with the need for developing flexible scheduling and providing children with both professional and non-professional services when they need it. We also find that the schools need a lot of help in organizing in terms of the amount of materials that are needed in order to make the IPI program work.

"The second problem we face in the retraining of administrators," Scanlon says, "is the general problem of communication. Since IPI depends upon the administrator of the school being the instructional leader and having the ability to meet with his staff and to help his teachers refine the system and solve problems, it means most principals need help in communication skills. A principal must know how to talk to his staff, elicit information from it, get it involved in the decision-making, and proceed with the refinement of the program. The role of the principal is to lead the continuous training of teachers in individualization," Scanlon says.

"The third problem we face in retraining administrators," he continues, "is the analysis of data. The principal needs new skills in looking at the flow of information that's passing through and over his desk concerning both the teachers and the students in his school. He needs to know what to look for in this wealth of data and how to analyze it in terms of refining the project."

Turning to teachers, Scanlon says experience in retraining teachers "leads us to conclude that, first of all, programs must be developed that will permit us to practice what we preach. Thus, IPI teachers must be taught in the same individualized climate they will use with their pupils.

New Technology Essential to IPI

IPI would never be possible to achieve without recent technical developments and innovations in instructional materials.

LRDC officials cite programmed textbooks, cartridge-loading tape recorders, and simplified film projectors as examples of essential IPI ingredients which have become available for the first time in the last few years.

Computer advancements are also considered essential to IPI's development. Computers are being used for the more detailed record keeping required by IPI, for data analysis, scheduling and program planning, and as basic units in a programmed instruction system.

The second conclusion that has been reached is that teachers when retrained for the specifics of IPI programs tend to overemphasize the mechanics of the system.

"Retraining of teachers has received considerable attention from RBS," Scanlon reports. "We have been concentrating our teacher education efforts on developing a teacher training program that will enable the school to conduct its own training program, that will enable the teachers to conceptualize a model of IPI as a basis for instructional decision-making in IPI, and that will enable the teachers to plan and conduct IPI in their classroom."

Scanlon says the RBS training program is being constructed upon the model of IPI and contains 12 specific packages each consisting of behavioral objectives, pre- and post-tests of the objectives, self-instructional materials and equipment, and recommended learning settings. Each package provides six types of activities. They include: concept-building related to IPI; analysis and application of the concepts to IPI; practice in using IPI skills and materials as routine exercises; working through the math continuum and assuming the role of teacher, aide, and student as needed; discussion designed to provide opportunity for clarification and expression of reaction and to develop and use skills for planning sessions to cover suggested topics, questions, or case studies.

"The 12 packages that have been prepared for the retraining of teachers have several general principles under which they operate," Scanlon says. "The first one is development of the specific packages of material to permit us to individualize the training program for teachers so we can, for once in our lives, practice what we preach. Secondly, developed in such a way that they can be carried by the U.S. mail so that administrators, with some help, can lead their faculties through these particular packages.

"The successful development of packages of materials to retrain teachers, hopefully, will put RBS out of the institute business and shift the responsibility for retraining local staff to local administration and college resources," Scanlon says.

OAKLEAF PROGRAM EXPORTED TO OTHER SCHOOLS

One of the principal goals of the 20 USOE regional educational laboratories is to export effective innovations into the public schools of the nation as quickly as possible. The aim: to reduce sharply the tragically wide gap in education between discovery of better ways and actually getting them into a significant number of classrooms.

RBS, as a regional laboratory, assumed the difficult and challenging task of exporting IPI to the schools of the nation--when it is ready. At present it is field testing IPI in 22 schools across the country.

RBS, unlike LRDC, functions in the world of the day-to-day problems of helping children learn. Its role is to test and to perfect innovations in the field and to bring better education to the attention, and within reach, of the public schools. This, of course, means that considerable effort must

be made in testing, evaluating, and modifying educational innovations. How well the materials do the job of helping pupils learn, how adaptable they are to the varying requirements of each pupil, how the individual pupil responds to this different approach, how the teacher's role changes, what happens to the pattern of staffing the school, what the effects are on the community and its expectations of the "system," and variations in cost are all carefully monitored and compared with other schools not using IPI.

RBS, responsible for the field development and testing of IPI, is currently working on IPI in the following schools: Helen Keller Middle School, Easton, Conn.; Brentwood Elementary School, Elk Grove, Ill.; Grantwood Elementary School, Des Plaines, Ill.; Alisal Elementary School, Salinas, Calif.; Boulder Creek Elementary School, Boulder Creek, Calif.; David Avenue Elementary School, Pacific Grove, Calif.; Foothill Elementary School, Monterey, Calif.; McAnnulty Elementary School, Pittsburgh, Pa.; Washington Elementary School, Trenton, N.J.; Richland Elementary School, Quakertown, Pa.; West Elementary School, Dover, Del.; Downey Elementary School, Harrisburg, Pa.; Courtright Elementary School, Wilkes-Barre, Pa.; North Elementary School, Wilkes-Barre, Pa.; Southwest Elementary School, Montclair, N.J.; Teaneck Elementary School, Teaneck, N.J.; East Stroudsburg State Teachers College Laboratory School, East Stroudsburg, Pa.; Friends Elementary School, Wilmington, Del.; Frank A. Berry School, Bethel, Conn.; Grassy Plain Elementary School, Bethel, Conn.; Center Elementary School, Bethel, Conn.; and Charter Oak Elementary School, West Hartford, Conn.

Four other schools are involved in the IPI project under supervision of LRDC. They are: Oakleaf Elementary School; Youth Development Center, Warrendale, Pa.; Hurst Junior High School, Mt. Pleasant, Pa.; and the Elizabeth Forward Junior High School, Elizabeth, Pa. The total enrollment in all IPI schools is 6,000. Most of these schools are limiting their participation to the IPI mathematics continuum.

RBS, being principally concerned with involving other schools in IPI, is establishing specific criteria that will help insure successful implementation of IPI. The criteria, Scanlon says, include the following five requirements:

- Administrative commitment. "By this we mean a self-study of IPI on the part of the local administration," Scanlon says. "This gives it a firsthand knowledge about the essential elements of IPI and an understanding of some of the financial implication involved. When this study is completed, the administration must be able to say that it can support IPI, not only in philosophy but financially as well."

- Teacher commitment. "We sincerely believe," Scanlon says, "that the teachers of any given school have the same right that the administration has in investigating a new instructional system that's to be used in their schools. Therefore, we ask that the faculty, or at least faculty representation, has an opportunity to visit an IPI demonstration school and talk to other teachers and be involved in the basic decision as to whether their school will or will not become an IPI school."

- Participation in research. "Both the teachers and the administration should know quite clearly the kinds of research questions they will be asked, the kinds of data that will be collected, the need for attitude surveys of both teachers and students, and additional achievement testing."

- An understanding of the need for both administrative and teacher retraining. "This understanding," Scanlon says, "must include the kind of training involved, and the time needed for training."

- Uniqueness of situation. "Here we are trying to take into consideration the past history of any given school in terms of its interest and efforts to promote individualization," Scanlon says.

ACHIEVEMENT RESULTS COMPARED

Evidence on how IPI affects pupil achievement is still fragmentary. Although limited testing and in-depth pupil observation have indicated remarkable successes, IPI Director Bolvin says "we'll need three to five more years perfecting IPI before we can conduct extensive research comparing IPI pupil achievement with the achievement of similar pupils in the traditional school. Our evaluation emphasis now is on improving curriculum and materials."

In Urbana, Illinois

A testing study conducted in Urbana, Ill., compared the mathematics and reading achievement of two similar groups of pupils aged five through seven.

One group of 200 pupils was given the IPI math and reading programs. It was paired with 200 students progressing through Urbana's regular ungraded primary program without "individualized" instruction. The test period lasted one school year, 1966-67. At the end of this period the pupils were given the California Achievement Test.

The result: the IPI pupils at almost all IQ levels scored better than those who were not exposed to IPI. At the lower primary level, IPI pupils in the 110-119 IQ range received a grade placement score of 2.97 in reading comprehension; similar non-IPI pupils received a grade placement score of 1.18. At the 140+ IQ level, IPI pupils scored 2.94 compared to 2.44 for the non-IPI pupils in reading comprehension.

In arithmetic fundamentals IPI lower primary pupils in the 110-119 IQ range scored 2.42; similar non-IPI pupils scored 1.97. At the middle primary level IPI pupils in the 120-129 IQ bracket received a grade placement score of 5.12 in reading comprehension, compared to 4.12 for non-IPI pupils.

However, in a few instances the IPI pupils scored lower than non-IPI pupils. At the 90-109 IQ level, for example, the non-IPI middle primary pupils scored 2.57 compared to 2.44 for the IPI group.

These are random samples indicating how IPI pupils compared with non-IPI pupils at both the lower primary and middle primary levels.

Despite these promising results in Urbana, IPI officials warn that in some cases IPI pupils might not compare favorably on standardized tests with students who have been exposed to more skills in a given subject. Why? Because IPI students do not proceed to new skills until they have achieved 85 percent mastery on each step on the sequential IPI curriculum ladder.

On the other hand, when students in conventional schools take the Oakleaf-created achievement tests, they do not do as well as IPI students. Only time will tell whether students who have experienced six years of IPI curriculum achieve better results as a general rule than those who have learned in the traditional manner.

Although IPI officials are personally convinced that a perfected IPI system will result in significant improvement in pupil achievement, they are wary of saying so for publication until they have more solid evidence.

Another outcome they expect from IPI which may be more significant than improving pupil skills involves pupil attitudes, self-motivation, and independence. James W. Becker, RBS executive director, predicts that IPI will produce pupils far more independent and self-directed than the current product of American schools. In addition, Becker believes they will be better problem solvers.

At Oakleaf

Studies of progress at Oakleaf show substantially more of the school's enrollment achieving at higher levels as students, teachers, and researchers obtained practice in individualizing instruction from year to year. The bar charts in Figure 14 (reproduced on page 25) show each grade at Oakleaf for the years 1965, 1966, and 1967.

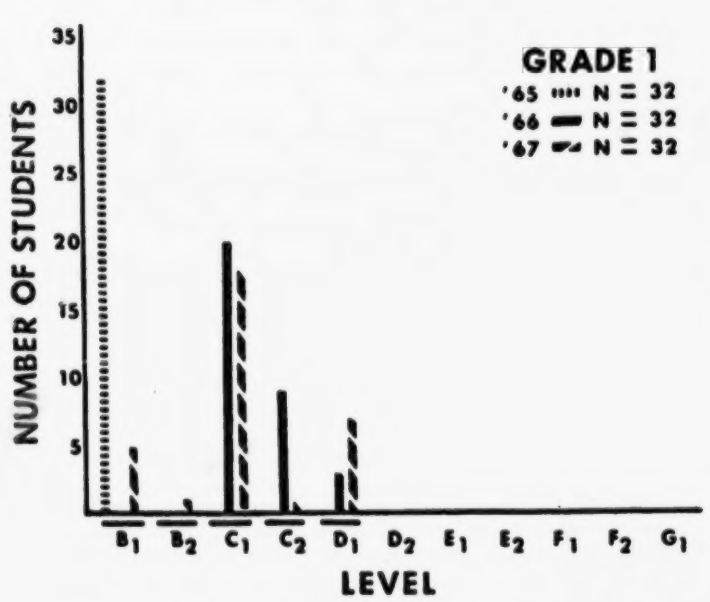
Figure 15 (reproduced on page 26) shows the total school over these three years. The height of the bar indicates the number of students ending up the school year at a particular level of the mathematics continuum. On the horizontal axis, each level is divided into two parts (Level A, the kindergarten level, is not shown).

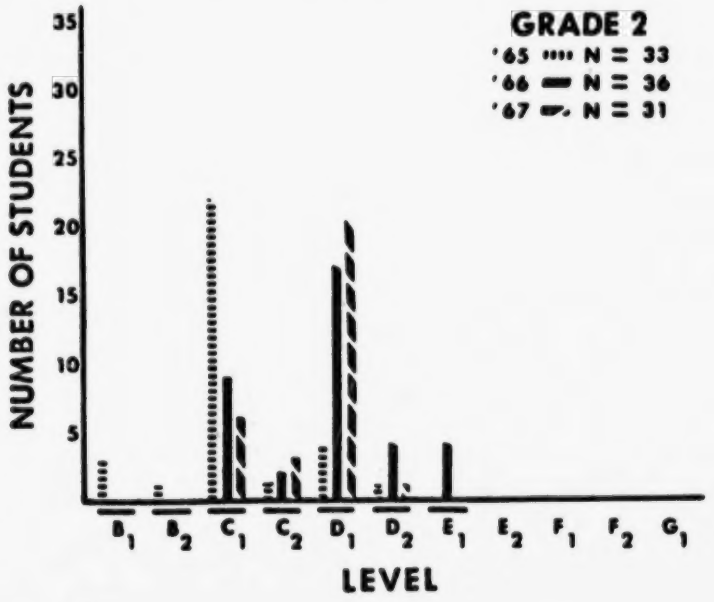
Figure 14 shows that in grade 6 approximately eight students were working at Level G-1 at the end of the 1966-67 school year; at the end of the 1965-66 school year only one sixth grader had reached level G-1. The general trend in Figure 14 is that attainment levels over the three years are moving up the mathematics continuum. Figure 15 shows this again and also shows that the spread of attainment is larger in 1967 than in the previous years.

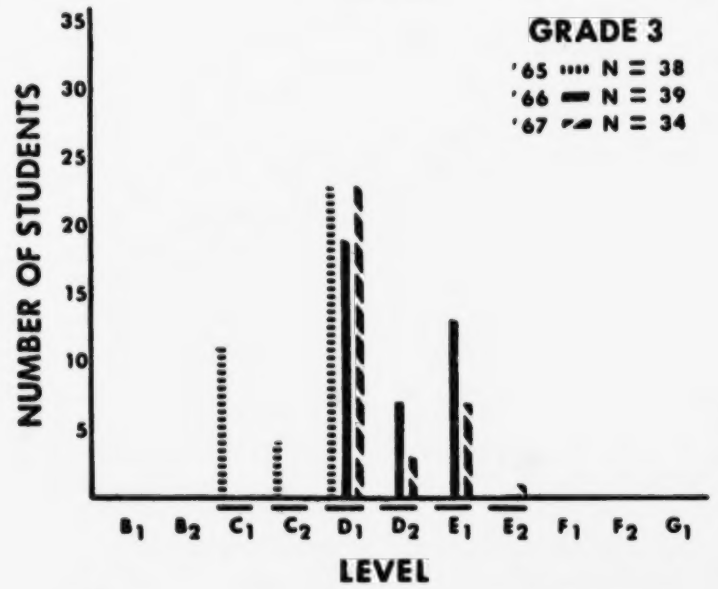
Notice in Figure 14 that in the first year of IPI in the first grade the system did not provide effective means for allowing the children to move on their own. As a result they ended up as a group in various units in the first half of Level B. As a result of this experience, Level A was moved into the kindergarten and materials and procedures were revised so that preparation of students for individualized learning could begin in kindergarten instead of the first grade. This permitted Oakleaf pupils to be more self-directed when they moved on to the first grade.

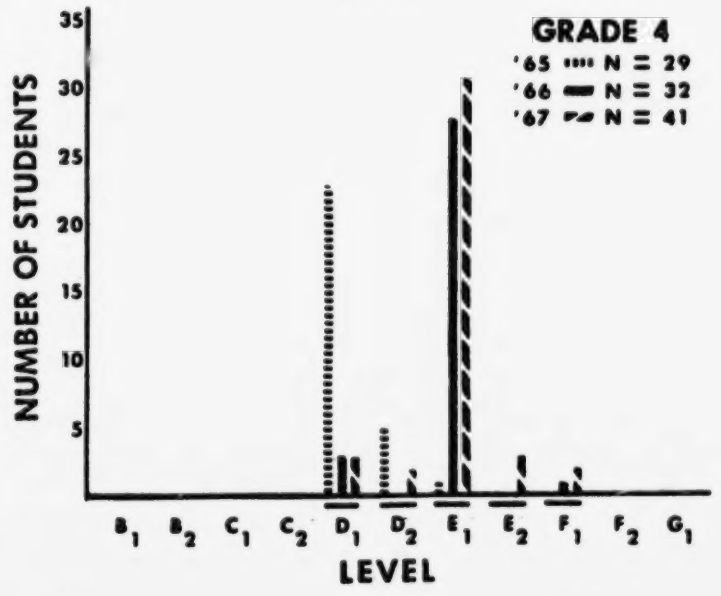
Figure 14

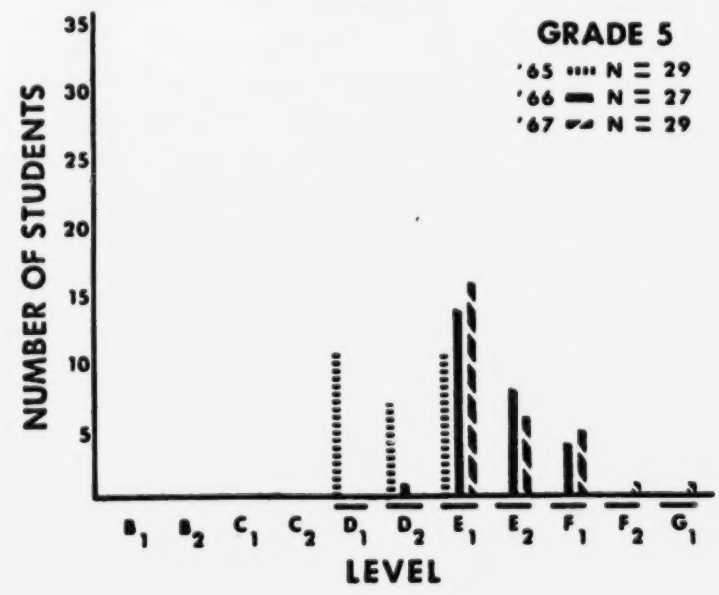
Curriculum Levels Attained by Students in Each Grade in June of 1965, 1966, and 1967











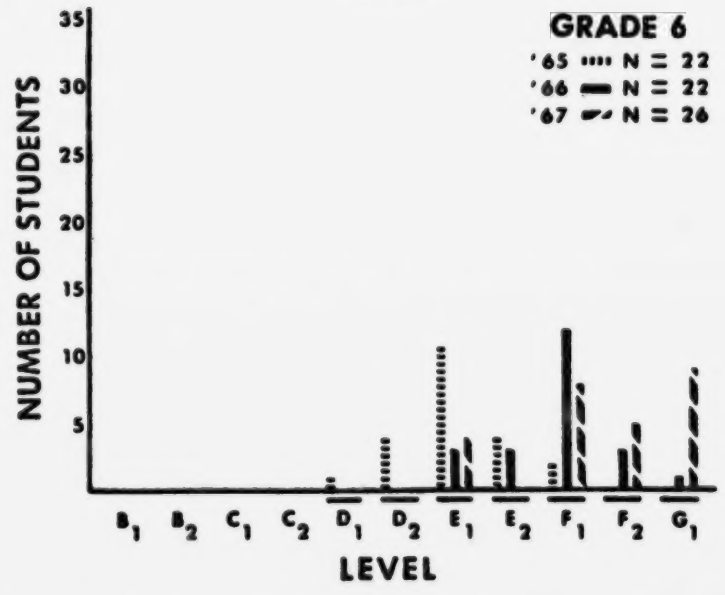
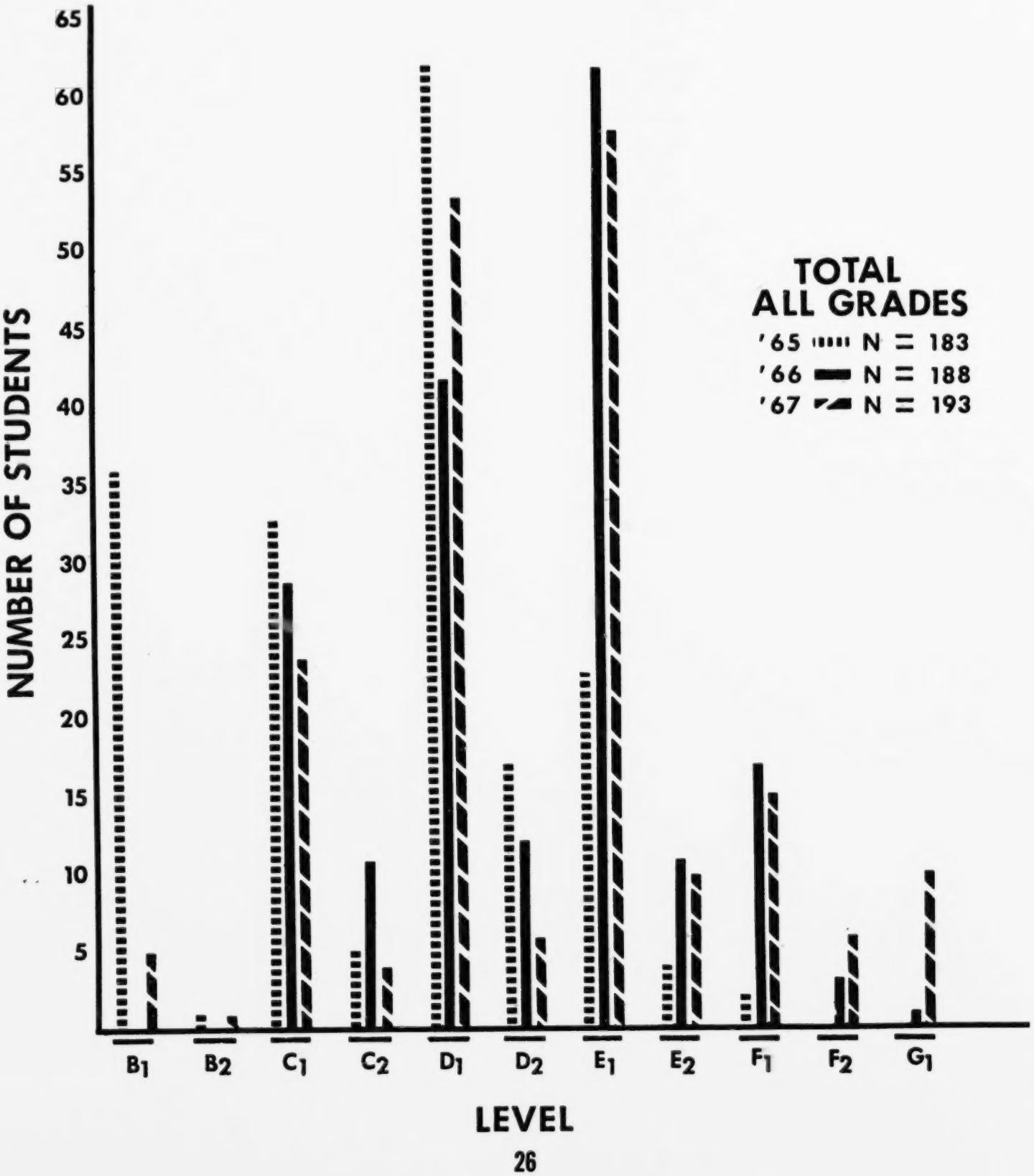


Figure 15

Curriculum Levels Attained by Students in All Grades in June of 1965, 1966, 1967



STUDENT PROGRESS CAREFULLY CHARTED

How do patterns of student progress vary under the IPI system? Figures 1 and 3 (see next page) present computer-plotted summary charts that show the progress of two different students working through the IPI mathematics continuum at the Oakleaf School over a three-year period. The vertical axis on the left-hand side of Figure 1 lists the numbers of the curriculum units. There are 88 units in the curriculum sequence. These unit numbers may or may not begin at 1 or end at 88 on each chart. This will depend on the level and unit at which the student is originally placed. General descriptions of sets of units are given along this axis to show what the student is working on. For example, around unit 40 a student would be working on beginning multiplication and division algorithms and on equivalent fractions. The vertical axis on the right-hand side shows the same thing. However, it also lists the levels A through E and the names of the units in the level.

Units mastered during a particular two-week period over the three years of school are plotted on the horizontal axis of Figures 1 and 3. When a unit has been mastered an X is plotted. An X is also plotted when a student requires review and repeats some work in a unit in order to retain proficiency.

The number of units mastered is one measure of a pupil's rate of progress through the curriculum. The average time to master a unit is 12 days with a range of 1 to 60 days. In Figures 1 and 3 the patterns of Xs show how achievement progresses for two very different students.

In Figure 1 Janie, a third grader, has worked up to unit 46 during her first three years of school. This relatively swift student is a sharp contrast to Jimmy, shown in Figure 3, who has worked to criterion on only 19 units over the same three-year period.

The bullets on the right-hand vertical axis of Figure 1 show the result of a test, prepared for the level or levels at which a student worked during the third year. Each bullet represents high mastery and retention--85 percent. A blank place represents a score of less than 85 percent. A dash means that the test was not given on that particular unit.

IPI officials report that the mean number of mathematics units mastered over the first three years is 37 for the 100 students who have been at Oakleaf for three years. The maximum number of units covered by a student is 73 and the minimum is 13, a wide range of 60 units. It has also been noted that the number of units covered increases in the higher years of work.

Computer Helps IPI Teacher

A computer-management system is being developed at Oakleaf School to help research and implement individualized instruction. Its purpose: Matching relevant measures of student performance with appropriate curriculum methods and materials to assist teachers in preparing instructional prescriptions for each student.

Figure 1 *Janie*

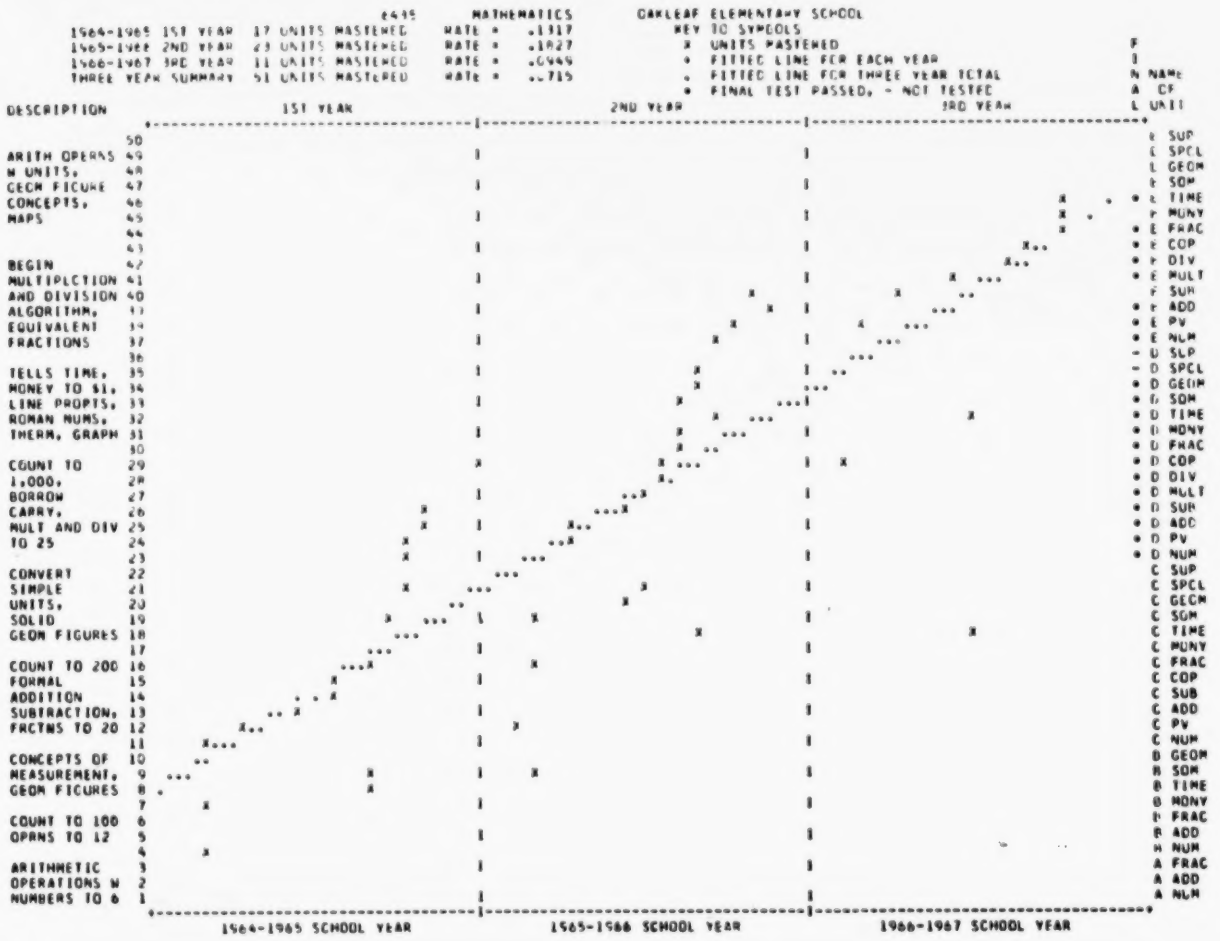
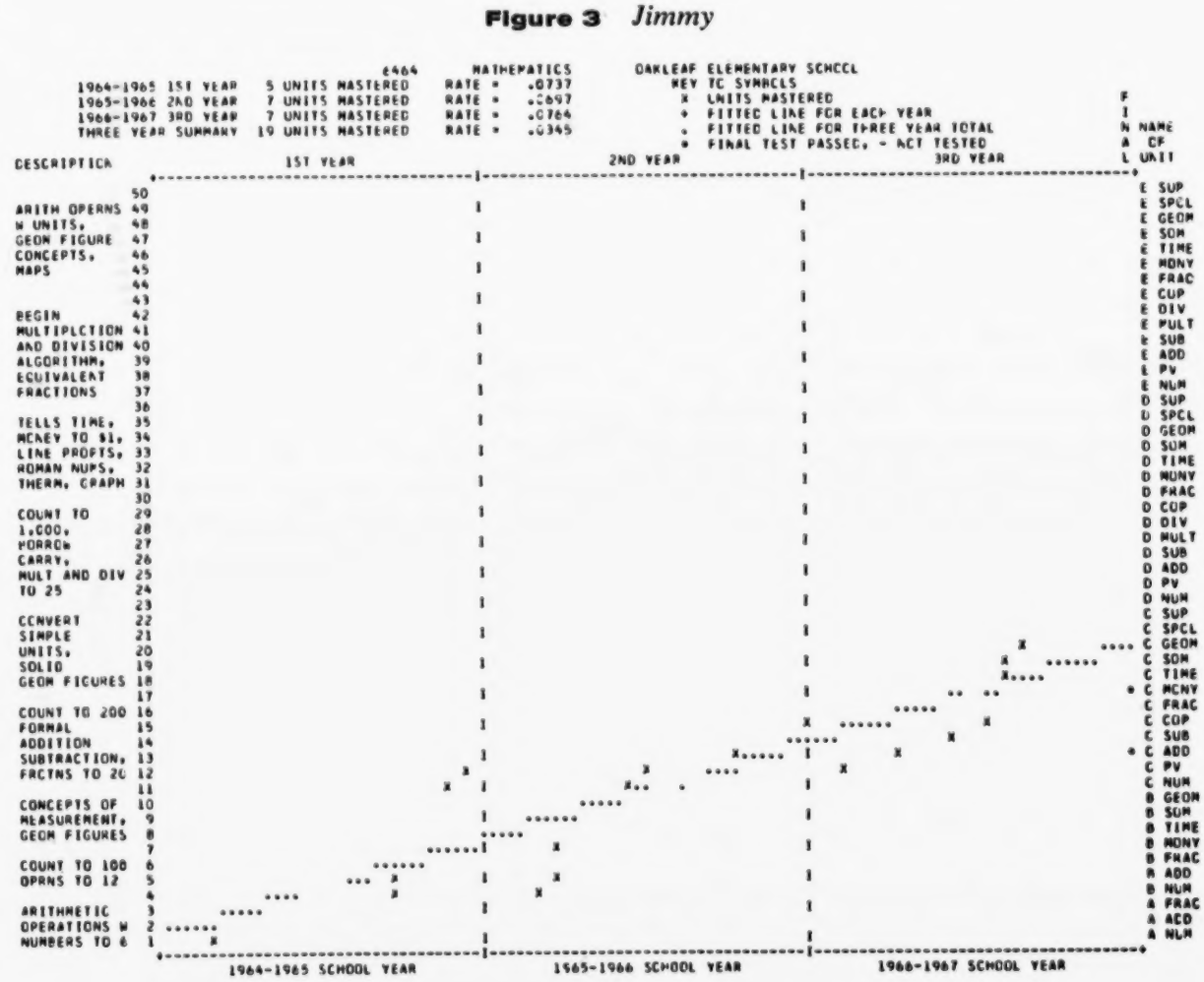

E445 MATHEMATICS OAKLEAF ELEMENTARY SCHOOL
1964-1965 1ST YEAR 17 UNITS MASTERED RATE = .1317
1965-1966 2ND YEAR 23 UNITS MASTERED RATE = .1827
1966-1967 3RD YEAR 11 UNITS MASTERED RATE = .0944
THREE YEAR SUMMARY 51 UNITS MASTERED RATE = .0715
KEY TO SYMBOLS
X UNITS MASTERED
• FITTED LINE FOR EACH YEAR
. FITTED LINE FOR THREE YEAR TOTAL
* FINAL TEST PASSED, - NOT TESTED
DESCRIPTION
1ST YEAR
2ND YEAR
3RD YEAR
F I N A L UNIT
ARITH OPERNS N UNITS, GEOM FIGURE CONCEPTS, MAPS
BEGIN MULTIPLCTION AND DIVISION ALGORITHM, EQUIVALENT FRACTIONS
TELLS TIME, MONEY TO $1, LINE PROPTS, ROMAN NUMS, THERM, GRAPH
COUNT TO 1,000, BORROW CARRY, MULT AND DIV TO 25
CONVERT SIMPLE UNITS, SOLID GEOM FIGURES
COUNT TO 200 FORMAL ADDITION SUBTRACTION, FRCTNS TO 20
CONCEPTS OF MEASUREMENT, GEOM FIGURES
COUNT TO 100 OPRNS TO 12
ARITHMETIC OPERATIONS W NUMBERS TO 6
1964-1965 SCHOOL YEAR
1965-1966 SCHOOL YEAR
1966-1967 SCHOOL YEAR

Figure 3 *Jimmy*


E464 MATHEMATICS OAKLEAF ELEMENTARY SCHOOL
1964-1965 1ST YEAR 5 UNITS MASTERED RATE = .0737
1965-1966 2ND YEAR 7 UNITS MASTERED RATE = .0697
1966-1967 3RD YEAR 7 UNITS MASTERED RATE = .0764
THREE YEAR SUMMARY 19 UNITS MASTERED RATE = .0345
KEY TO SYMBOLS
X UNITS MASTERED
• FITTED LINE FOR EACH YEAR
. FITTED LINE FOR THREE YEAR TOTAL
* FINAL TEST PASSED, - NOT TESTED
DESCRIPTION
1ST YEAR
2ND YEAR
3RD YEAR
F I N A L UNIT
ARITH OPERNS N UNITS, GEOM FIGURE CONCEPTS, MAPS
BEGIN MULTIPLCTION AND DIVISION ALGORITHM, EQUIVALENT FRACTIONS
TELLS TIME, MONEY TO $1, LINE PROPTS, ROMAN NUMS, THERM, GRAPH
COUNT TO 1,000, BORROW CARRY, MULT AND DIV TO 25
CONVERT SIMPLE UNITS, SOLID GEOM FIGURES
COUNT TO 200 FORMAL ADDITION SUBTRACTION, FRCTNS TO 20
CONCEPTS OF MEASUREMENT, GEOM FIGURES
COUNT TO 100 OPRNS TO 12
ARITHMETIC OPERATIONS W NUMBERS TO 6
1964-1965 SCHOOL YEAR
1965-1966 SCHOOL YEAR
1966-1967 SCHOOL YEAR

QUESTIONS OFTEN ASKED ABOUT IPI

(Answers were prepared by IPI Project Director Scanlon at RBS.)

Q Does IPI need a specially-built school?
A No.

Q Are students selected for this project?
A No.

Q What is the relationship between the Learning Research and Development Center (LRDC) of the University of Pittsburgh and Research for Better Schools (RBS)?
A The Learning Research and Development Center is responsible for development and improvement of the model at Oakleaf School. Research for Better Schools is responsible for field testing and dissemination of IPI.

Q Where do the Learning Research and Development Center and Research for Better Schools receive their financial support?
A The Learning Research and Development Center is funded by the U.S. Office of Education and the University of Pittsburgh. Additional support comes from A. W. Mellon Education and Charitable Trust, Buhl Foundation, Carnegie Corporation of New York, Ford Foundation, and Office of Naval Research. Research for Better Schools is funded by Title IV, Elementary and Secondary Education Act.

Q Who are the people in charge of IPI projects?
A The Learning Research and Development Center is directed by J. O. Bolvin and its steering committee is chaired by C. M. Lindvall. Research for Better Schools' IPI project director is Robert J. Scanlon, former principal at the Oakleaf School.

Q When was IPI first launched in a school setting?
A It began in 1963.

Q What kind of inservice training is required for teachers shifting to IPI?
A All teachers are asked to work in IPI summer workshops. The best training seems to be on the job. This gives the new teacher an opportunity to associate with an experienced person for a short period of time.

Q What are some implications for teacher education courses in colleges and universities?
A There appears to be a need for courses in small-group dynamics, tutorial instruction, individual progress diagnosis, prescription writing, child psychology, child behavior and learning patterns, and testing and measurement.

Q What kind of grouping do you do in IPI?
A There is no homogeneous grouping. The pupils in the self-contained classroom are heterogeneous. On occasion, when the need arises,

pupils from the same or different classrooms are grouped for instructional purposes. These pupils have similar problems relating to a common skill or unit.

Q At the present time, can IPI be initiated in a conventional elementary school at a cost compatible with that school's operational budget?
A No. But with continuous refinements in the system and more research designed to lower the cost, IPI project directors hope IPI can be placed in a conventional elementary school at a reasonable cost in the very near future. Most important is the complete cooperation needed from all persons involved in initiating IPI in a new school.

Q What kind of progress report goes home to the parent?
A This varies from school to school. No one best way has been found.

Q Who scores the pupil's work?
A A child's work page is either scored by himself or by an aide. The teacher's time is spent on evaluating the work after it is scored. All tests (placement, curriculum-embedded, pre- and post-) are scored by aides.

Q Do pupils in IPI receive the new or modern math?
A Strictly speaking, no. However, the math curriculum does include many concepts which can be considered modern or new math.

Q Do you have group instruction in IPI?
A Yes. The seminar periods in math and reading are definitely group instruction as are groupings for special reasons.

Q How does IPI allow the teacher to follow each of 30 children in her class?
A IPI rests upon information and materials. In order to evaluate and make assignments for each student, the teacher needs a great deal of up-to-date information about the work and academic history of each student. When he makes an individualized assignment, the assigned material must be readily available without fail.

Q What subjects are involved in IPI procedures?
A K-6 in mathematics and reading; K-3 in science; 2-6 in spelling. Efforts are now under way to prepare social science for IPI.

Q Why were these subjects chosen?
A Because these are the basic tools of intellectual development which must be used in any future job or future learning. Lack of mastery in these areas causes a child to fall further and further behind his classmates.

Q How is the curriculum arranged if every student is working independently on his own assignment?
A The curriculum is spelled out in a few hundred objectives for each subject. These objectives are stated in terms of what the student must do at every step in order to convince the teacher (and himself) that he has mastered the curriculum objective and that he is ready

to go on. At other times the size of the group varies from 3 to 15 pupils, depending on the learning task. The decision that certain pupils with similar problems in math, reading, science, or spelling should be grouped for instruction usually comes out of a teacher planning session. The length of the grouping period may vary from 10 to 40 minutes.

Q Do pupils from different grades ever receive instruction together?
A Yes. If two children in fifth grade are having a problem similar to three children in the sixth grade, the pupils may be brought together in a small group for instruction. After the instruction they return to their usual work area and continue their IPI work.

Q How is the library related to the IPI reading program?
A The library is always open for the pupils and there is no limit on the number of books a child may take out. Sometimes complete IPI classes are held in the library. At other times children are seen going in and out of the library for different purposes. An honor system is used in checking books in and out.

Q Is there any homework in IPI subjects?
A Not usually. However, several of our schools have used the prescription material as homework assignments in specific cases.

Q Doesn't the daily writing of prescriptions become boring?
A Not usually. Most teachers accept the challenge of prescribing informational materials in a professional manner.

Q What help does the teacher receive in the record-keeping, scoring, and material management which IPI requires?
A The IPI system, as now operated, requires the use of nonprofessional staff (teacher's aides). While scoring and checking information is vital to the success of the program, in some cases students can correct their own material.

Q Does IPI mean that the student is always working by himself?
A No. Teachers as diagnosticians and prescribers of instruction place each youngster in the setting in which he functions best. This may mean group instruction.

Q How do parents react to IPI?
A Very favorably.

Q What happens to a student from another school who comes into an IPI classroom?
A Diagnostic instruments permit quick assessment of his strengths and weaknesses. Therefore, proper instructional setting and tests can be quickly assigned.

Q What happens to an IPI student who goes to another school?
A The IPI school is able to provide more specific information about the student to his new school. What that school does with the information varies.

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More Detailed Information Available

Additional information on the IPI program can be obtained by writing to Robert G. Scanlon, IPI director at Research for Better Schools, Inc., 121 S. Broad St., Philadelphia, Pa. 19107.

Scanlon reports, for example, that charts of the complete IPI mathematics and reading continuum for kindergarten through the sixth grade are available at his office on request.

He says he and his staff will be happy to answer questions this report has stimulated about IPI. His phone number is (215) 546-6050.